Claims

1. A thin film magnetic recording medium for use with a magnetic recording head comprising:

an upper ferromagnetic layer having a first magnetic anisotropy and being nearest to a surface of the thin film magnetic recording medium;

a lower ferromagnetic layer having a second magnetic anisotropy which is lower than the first magnetic anisotropy by an amount selected to compensate for a lower magnetic field from the magnetic recording head due to a larger distance between the magnetic recording head and the lower ferromagnetic layer; and

a nonmagnetic spacer layer separating the upper and lower ferromagnetic layers.

2. The thin film magnetic recording medium of claim 1 wherein the upper ferromagnetic layer switches in response to a first magnetic field generated by a first write current magnitude in the magnetic recording head and the lower ferromagnetic layer switches in response to a second magnetic field generated by a second write current magnitude in the magnetic recording head and the first and second write current magnitudes are approximately equal.

3. The thin film magnetic recording medium of claim 1 wherein normalized DC erase noise plotted versus a write current in the magnetic recording head has a single peak.

4. The thin film magnetic recording medium of claim 1 wherein the upper and lower ferromagnetic layers include cobalt and platinum and the lower ferromagnetic layer has a lower atomic percentage of platinum than the upper ferromagnetic layer.

5. The thin film magnetic recording medium of claim 1 wherein the upper and

lower ferromagnetic layers comprise cobalt, platinum, chromium and boron and the lower ferromagnetic layer has a lower atomic percentage of platinum than the upper ferromagnetic layer.

6. The thin film magnetic recording medium of claim 1 wherein the upper ferromagnetic layer has a magnetization which is higher than a magnetization of the lower ferromagnetic layer.

7. A thin film magnetic recording medium for use with a magnetic recording head comprising:

an upper ferromagnetic layer having a first magnetic anisotropy;

a first spacer layer adjacent to the upper ferromagnetic layer; and

an antiferromagnetically coupled (AFC) magnetic layer structure having an AFC-master ferromagnetic layer and an AFC-slave ferromagnetic layer that are antiferromagnetically coupled across a second spacer layer, the AFC-master ferromagnetic layer being disposed so that the first spacer layer separates the AFC-master ferromagnetic layer from the upper ferromagnetic layer, and the AFC-master ferromagnetic layer having a second magnetic anisotropy which is lower than the first magnetic anisotropy by an amount selected to compensate for a lower magnetic field from the magnetic recording head due to a larger distance between the magnetic recording head and the AFC-master ferromagnetic layer.

8. The thin film magnetic recording medium of claim 7 wherein the upper ferromagnetic layer switches in response to a first magnetic field generated by a first write current in the magnetic recording head and the AFC-master ferromagnetic switches in response to a second magnetic field generated by a second write current in the magnetic recording head and the first and second write currents are approximately equal.

9. The thin film magnetic recording medium of claim 7 wherein normalized DC

erase noise plotted versus a write current in the magnetic recording head has a single peak.

10. The thin film magnetic recording medium of claim 7 wherein the upper ferromagnetic layer and the AFC-master ferromagnetic layer include cobalt and platinum and the AFC-master ferromagnetic layer has a lower atomic percentage of platinum than the upper ferromagnetic layer.

11. The thin film magnetic recording medium of claim 7 wherein the upper ferromagnetic layer and the AFC-master ferromagnetic layer comprise cobalt, platinum, chromium and boron and the AFC-master ferromagnetic layer has a lower atomic percentage of platinum than the upper ferromagnetic layer.

12. The thin film magnetic recording medium of claim 7 wherein the upper ferromagnetic layer has a magnetization which is higher than a magnetization of the AFC-master ferromagnetic layer.

13. A thin film magnetic recording medium for use with a magnetic recording head comprising:

an antiferromagnetically coupled magnetic layer structure having an AFC-master ferromagnetic layer and an AFC-slave ferromagnetic layer that are antiferromagnetically coupled across a first spacer layer, the AFC-master ferromagnetic layer having a first magnetic anisotropy;

a second spacer layer adjacent to the AFC-slave ferromagnetic layer; and

a lower ferromagnetic layer having a second magnetic anisotropy which is lower than the first magnetic anisotropy by an amount selected to compensate for a lower magnetic field from the magnetic recording head due to a larger distance between the magnetic recording head and the lower ferromagnetic layer, the lower ferromagnetic layer being disposed so that the second spacer layer separates the lower ferromagnetic layer from the AFC-slave ferromagnetic layer.

14. The thin film magnetic recording medium of claim 13 wherein the AFC-master ferromagnetic layer switches in response to a first magnetic field generated by a first write current magnitude in the magnetic recording head and the lower ferromagnetic layer switches in response to a second magnetic field generated by a second write current magnitude in the magnetic recording head and the first and second write current magnitudes are approximately equal.

15. The thin film magnetic recording medium of claim 13 wherein normalized DC erase noise plotted versus a write current in the magnetic recording head has a single peak.

16. The thin film magnetic recording medium of claim 13 wherein the lower ferromagnetic layer and the AFC-master ferromagnetic layer include cobalt and platinum and the lower ferromagnetic layer has a lower atomic percentage of platinum than the AFC-master ferromagnetic layer.

17. The thin film magnetic recording medium of claim 13 wherein the lower ferromagnetic layer and the AFC-master ferromagnetic layer comprise cobalt, platinum, chromium and boron and the lower ferromagnetic layer has a lower atomic percentage of platinum than the AFC-master ferromagnetic layer.

18. The thin film magnetic recording medium of claim 13 wherein the AFC-master ferromagnetic layer has a magnetization which is higher than a magnetization of the lower ferromagnetic layer.

19. A thin film magnetic recording medium for use with a magnetic recording head comprising:

a first AFC-master ferromagnetic layer and a first AFC-slave ferromagnetic layer that are antiferromagnetically coupled across a first spacer layer, the first AFC-master ferromagnetic layer having a first magnetic anisotropy;

a second spacer layer adjacent to the first AFC-slave ferromagnetic layer; and

a second antiferromagnetically coupled magnetic layer structure, disposed below the first antiferromagnetically coupled magnetic layer structure and the second spacer layer, having a second AFC-master ferromagnetic layer and a second AFC-slave ferromagnetic layer that are antiferromagnetically coupled across a third spacer layer, the second AFC-master ferromagnetic layer having a second magnetic anisotropy that is lower than the first magnetic anisotropy by an amount selected to compensate for a lower magnetic field from the magnetic recording head due to a larger distance between the magnetic recording head and the second AFC-master ferromagnetic layer, the second antiferromagnetically coupled magnetic layer structure being disposed so that the second spacer layer separates the second AFC-master ferromagnetic layer from the first AFC-slave ferromagnetic layer.

20. The thin film magnetic recording medium of claim 19 wherein the first AFC-master ferromagnetic layer switches in response to a first magnetic field generated by a first write current magnitude in the magnetic recording head and the second AFC-master ferromagnetic layer switches in response to a second magnetic field generated by a second write current magnitude in the magnetic recording head and the first and second write current magnitudes are approximately equal.

21. The thin film magnetic recording medium of claim 19 wherein normalized DC erase noise plotted versus a write current in the magnetic recording head has a single peak.

22. The thin film magnetic recording medium of claim 19 wherein the first and second AFC-master ferromagnetic layers include cobalt and platinum and the second AFC-master ferromagnetic layer has a lower atomic percentage of platinum than the first AFC-master ferromagnetic layer.

23. The thin film magnetic recording medium of claim 19 wherein the first and second AFC-master ferromagnetic layers comprise cobalt, platinum, chromium and boron and the second AFC-master ferromagnetic layer has a lower atomic percentage of platinum than the first AFC-master ferromagnetic layer.

24. The thin film magnetic recording medium of claim 19 wherein the first AFC-master ferromagnetic layer has a magnetization which is higher than a magnetization of the second AFC-master ferromagnetic layer.

25. A method of fabricating a thin film recording medium comprising the steps of:

depositing an AFC-slave ferromagnetic layer on an underlayer;

depositing a first spacer layer on the AFC-slave ferromagnetic layer, the first spacer layer having a thickness selected to antiferromagnetically couple the AFC-slave ferromagnetic layer to an AFC-master ferromagnetic layer;

depositing an AFC-master ferromagnetic layer having a first magnetic anisotropy on the first spacer layer selected to be lower than a second magnetic anisotropy by an amount selected to compensate for a lower magnetic field from the magnetic recording head;

depositing a second spacer layer on the AFC-master ferromagnetic layer; and

depositing an upper ferromagnetic layer having a second magnetic anisotropy on the second spacer layer, the second magnetic anisotropy being higher than the first magnetic anisotropy.